SAMPLE HOUSING AUTHORITY ENERGY AND WATER AUDIT

REQUEST FOR PROPOSALS (RFP)

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Utilities and Waste Disposal Audit and Energy Efficiency Financing Feasibility Study

I. INTRODUCTION AND BACKGROUND

The Public Housing Authority (PHA) maintains and operates approximately xxx residential dwelling units, office spaces and storage areas at xx different sites comprising xx buildings throughout xxx. The apartments range from one (1) bedroom 400 sq. ft. units to six (6) bedroom 1500 sq. ft. units. The buildings range from xxx story structures to xx stories. All the structures were built in the 1940's, 1950's and early 1960's and excepting for major renovation work consist of xx construction. Xxx sites feature their own central physical utility plant for the supply of heat and hot water and other utility services.

The PHA has over the xxx years maintained and operated the buildings with over $ xxM in capital improvements to its systems, components and living spaces. Although many improvements have been made, new cost effective energy conservation measures need to be investigated and sought.

The PHA last performed an energy and water audit of its facilities approximately xx years ago. Since that time numerous renovations, modernization's and upgrades to the housing stock and physical plants have been made.

In addition, recent developments in the utilities field and in the Department of Housing and Urban Development (HUD) regulations prompt us to expand the scope of our traditional HUD "audit". The scope of work requested in this RFP includes a conventional HUD energy, water and waste audit plus three new tasks:

(1) an investigation of the potential for reducing costs and/or improving service by procuring alternative services of gas and electricity in a deregulated marketplace;
(2) an examination of the prospects for energy efficiency financing (also known as energy performance contracting) at one or more developments within our portfolio; and
(3) an investigation of possible cost reduction options associated with our disposal of

solid waste, since waste disposal savings can now be accommodated within an energy performance contract.

The PHA is seeking the services of a professional consulting firm experienced with performance of energy audits and recommending energy conservation, solid waste cost reduction measures, and commodity fuels procurement options that will result in cost savings to the PHA pursuant to the scope of work described below. Finally, and importantly, we are interested in the feasibility of undertaking energy efficiency financing at some or all of our sites. All audits must **honor** the standards and requirements of HUD.

II. PROJECT OBJECTIVES

It is the sole responsibility of the firm to provide all information requested and meet all requirements of this RFP. If any of the required information is not provided or requirements not met, the PHA may, at its sole discretion, remove the proposal from any further consideration. All information must be clear, concise and complete.

All proposals must be submitted at time scheduled as directed in the letter of invitation. Proposals received after this date and time for any reason shall not be considered.

III. SCOPE OF WORK

A. SCOPE BY BUILDING TYPE

- The Contractor shall undertake an investigation of potential energy conservation and/or cost reduction measures, their costs, savings estimates and paybacks for the Authority which addresses the following:

    1) High Rise Developments
    2) Townhouse and Garden Style Buildings

For the above respective categories, undertake an investigation which considers the options included in the attached Measure Table (see Appendix C).

B. GENERAL

- Perform an in-depth field survey of all buildings (including a sufficient number of dwelling units), community spaces administrative management offices, after school, head start, boiler, mechanical, and electrical facilities. Also include a thorough review of all energy related modernization plans implemented within the past twenty (20+) plus years by the PHA. Anticipate a minimum of xx hours of meeting, plan reviews and site visits with PHA staff to assure complete understanding of past improvements.

- Perform an Energy Audit for the purpose of complying with Federal Register 24 CFR Part

965, Subpart C Energy Audits and Energy Conservation Measures. The Contractor shall, as stated in this section *"...analyze all of the energy conservation measures, and the payback period of these measures that are pertinent to the type of buildings and equipment operated by the PHA* [Authority]". The Contractor shall rank the energy and water conservation measures according to the provisions of 24 CFR 965.304

- The audit shall consider, but not be limited to, energy conservation opportunities such as:

Architectural:	General project and building operation, envelope construction, etc.
HVAC Systems:	Central and individual space heating, air conditioning, piping, ventilation, distribution, equipment and controls, etc.
Secondary Systems:	Domestic hot water, central laundry facilities, plumbing fixtures, waste disposal, etc.
Electrical Systems:	Lighting, site lighting, electrical equipment, etc.

A longer list appears in Appendix C. An illustrative Audit Outline appears in Appendix E.

- [ ] If box is checked, provide a full equipment inventory as described in Appendix F.

C. ENGINEERING METHODOLOGY

a. General

The following building energy use simulation software packages may be appropriate for the energy use and savings analysis requested in this RFP:

BLAST (Building Loads Analysis and System Thermodynamics)
DOE-2
PowerDOE
EZDOE
VisualDOE
HAP v.4.0 (Hourly Analysis Program)
TRACE 600 (Trane Air Conditioning Economics)
Carrier

Information about these software packages in available from their manufacturer (see Appendix B for contact information).

The Contractor may utilize any of the simulation software packages listed above, provided that:

1. The Contractor can demonstrate that the software is appropriate for analysis of multifamily dwellings of the size and type as those described in the RFP and will

generate accurate estimates of the annual energy use and savings potential for all measures under consideration,

2. The software's assumptions and conclusions can be presented in a manner that is understandable and reviewable by the client, and

3. It is not technology or fuel-biased.

The Contractor may propose to use any other simulation software or engineering analysis method, either commercially available, or developed in-house, provided that the Contractor presents evidence in the Audit, and the PHA accepts such evidence, that the simulation/analysis method meets the above general criteria. For example, in-house simulation software utilizing a spreadsheet/bin method of analysis would be acceptable for certain applications.

As a guide to the appropriateness and applicability, the simulation/analysis method must minimally allow for the following input and output parameters for each measure under consideration:

Manufacturer's Rated Size of Equipment (kW, Mbtu, gallons, etc.)
Manufacturer's Rated Efficiency of Equipment

Estimated or Metered Annual Energy/Water Use of Measure
Present Cost Per Unit of Energy/Water
Post Retrofit Cost per Unit Estimate

Calculated Non-Interactive Energy/Water Use and Cost Reduction
Calculated Interactive Energy/Water Use and Cost Reduction

Measure Simple Payback
Combined Recommended Measure Simple Payback (Capital plus Quick Payback)

In addition, the Contractor must evaluate the following parameters, as applicable, for every measure under consideration, whether or not the selected simulation software incorporates them:

Effect on Indoor Air Quality
Age of Equipment
Condition of Equipment
Useful Life of Equipment
Post Retrofit Annual Maintenance Cost Additions/Subtractions Estimate
Post Retrofit Equipment Operation Requirements

For purposes of an energy performance contract, based on HUD 24 CFR Part 965 and 990.109 as cited above, the effect of net maintenance cost shall not be included in the primary illustration of simple payback, but shall be stated separately in supporting documentation.

The above parameters must be analyzed on an annual basis using the site's actual energy and water use profile, actual and current energy and water rates, and hourly heating and/or cooling

degree day data for the period(s) analyzed. The Contractor must adjust the data for variations in occupancy and time-dependent variations of equipment use, such as weekend schedules and timer-controlled equipment. All heating, ventilation, cooling and domestic hot water equipment shall be simulated using capacities, rated efficiencies, and part-load performance data for the equipment as provided by the equipment manufacturer, unless the Contractor presents written evidence that some condition exists that warrants the use of a different value.

b. Comprehensiveness

At the initial level of inspection, the Contractor shall consider all possible energy and water saving and cost reduction measures given the building components and systems at the site(s). The attached Measure Table (Appendix C) is intended to serve as a guide to the Contractor. Other measures may be appropriate on a case-by-case basis. It is the responsibility of the Contractor to identify any other saving or cost reduction opportunities.

The Study shall include the Contractor's statement supporting the removal of any measure or measures from further consideration. Upon request of the PHA, the Contractor must provide all analytical documentation supporting such removal.

The report should rank all measures with 20-year paybacks or less, listed from quickest payback to longest. The Contractor, at the request of the PHA, shall include paybacks for capital improvement measures, such as replacement windows. The Contractor shall be required to analyze up to 10 capital improvement measures which have simple paybacks in excess of twenty years. All calculations and illustrations of "measure packages" shall include the interactive effect of the selected measures, if any. The engineering methodology upon which the interactive relationships are derived must be clearly stated and explained in the Study text.

The Contractor shall enter and inspect at least one of each apartment type in each building type at each development. For a development with multiple heating system models or models more than five years different in age at least one system type or vintage should be inspected. The Contractor shall inspect every development listed in this RFP.

The Contractor should identify any opportunity for bulk purchasing, quantity discounts, vendor rebate or discounts and utility specials (funding of fuel switch, subsidizing selected technologies.

If the Contractor encounters any perceived hazardous materials at the Site(s), which may interfere with the proposed Work, the Contractor shall note such perceived conditions in the Audit. The PHA shall be responsible for confirmation that such material is hazardous, proper removal and disposal or containment, as the case may be, of the hazardous materials to the extent necessary to allow the Work to be done.

D. MINIMUM ENERGY EFFICIENCY FINANCING EVALUATIVE CRITERIA

The Contractor shall:

- Separately consider the feasibility of energy efficiency financing consistent with 24 CFR Part 965 and 990.109 (energy performance contracting) for specific developments and/or measures. In doing so, consider in addition to measures with paybacks of 20 years or less, the following criteria:

  1) *Scheduled heating/cooling/DHW/distribution system replacement*. If the mechanical systems are due for replacement during the next five-seven years, this development deserves serious consideration, regardless of the estimated systems payback: many replacement systems have paybacks of 20-25 years, but are good candidates because savings from other measures at the development, or from quick payback measures (lighting, water, controls) at other developments, can amortize the debt service payments required;

  2) *Mechanical systems with high maintenance, operational costs*. Regardless of age, some heating systems fail to perform as expected and require excessive maintenance costs to keep them running;

  3) *Necessary window replacements*; again, regardless of the payback period, these sites may be good candidates for the reasons stated above;

  4) *Equipment measures scheduled for replacement in PHA's Five Year Comprehensive Grant Program (CGP) Plan*;

  5) *Developments expected to remain under PHA management for at least the next decade;*

  6) *Developments and measures with a rich savings stream supported by relatively low cost investments*: these are good candidates because their savings can support more expensive, higher payback measures, as in 1-3 above;

  7) *Developments with central laundries*: even if such a development is not otherwise a good candidate, the laundry room may be worth addressing, with others at additional developments, or on its own;

  8) *Developments with incinerators, especially those generating air emissions problems*: the new public housing bill now includes waste management as an eligible activity for energy efficiency financing; and

  9) *Other criteria articulated by PHA personnel*; contractor should initially interview Energy, Modernization and Maintenance Department managers to determine if there are other criteria to add to this list.

- Indicate which developments and measures are good candidates for energy efficiency financing, and estimate the capital improvement value of such a contract.

- Review and analyze the data resulting in the compilation of Operation and Maintenance Opportunities and viable Energy Conservation Opportunities ranked according to cost and effectiveness.

- Prepare cost/benefit analysis for recommended capital expenditures and make recommendations for operation and maintenance improvements not requiring a capital expenditure. Also, include analysis of installation costs, operating costs, payback period and energy conserved for each recommendation at each site.

- Investigate and recommend whether the purchase of gas and electric utilities through local utilities remains the more cost effective option to PHA; consider the feasibility and cost reduction potential of wellhead gas and purchases of electricity from power marketers. If feasible, provide an updated list of reputable vendors of both commodities, complete with contact names, addresses, telephone, and fax numbers.

- Investigate and recommend solid waste disposal options which might reduce PHA costs, including source reduction, recycling, and alternative disposal contractors and contract terms. Recommend the more cost effective options to PHA.

IV. DELIVERABLES AND SCHEDULE

- The Contractor shall furnish the PHA with six (6) copies of a Survey and Draft Report and, upon completion of PHA review and comment on the draft report, furnish the PHA with six (6) copies of a Final Report in a format consistent with the "Audit Outline" presented in Appendix E.

- Completion Schedule

Survey and Draft Report	120 days
Final Report	30 days from receipt draft comments from the PHA
Total time for completion	150 days, minimally

V. PRICE

Provide fixed fee for entire scope plus hourly rates for each named professional if scope is later modified.

VI. PROPOSAL REQUIREMENTS

A. PROPOSAL INSTRUCTIONS

INTRODUCTION

All responses for providing architectural, engineering and other professional services under this Request for Proposals (RFP) must include all of the elements described in this Section. It is recommended that firms read the entire RFP before proceeding to draft any of the required elements of the proposal to be submitted.

The firm should provide a one page letter of introduction briefly describing your understanding of the requested scope of work, and your qualifications to undertake this work; (ensure that confirmation of the required three years of corporate experience is stated). The letter should specifically identify the members of the firm who would be assigned to provide requested type of service to the Public Housing Authority (PHA), if the firm is awarded the contract.

All proposals must then include the following elements:

1. STATEMENT OF PROFESSIONAL EXPERIENCE AND QUALIFICATIONS

State your firm's professional experience which offers evidence of qualifications to perform the requested services as described in Section III of this RFP, Scope of Work. The PHA is most interested in the firm's work with other public housing authorities or multifamily buildings, the Department of Housing and Urban Development (HUD). We suggest inclusion of specific recent and current clients. (Note: The PHA shall presume that the firm has no objection to the PHA contacting listed clients to review the firm's past performance, cost control, ability to meet schedules and client satisfaction).

State the principals of the firm who will be assigned to perform the PHA work. Ensure that in the description of the firm's EXPERIENCE it is very clear to what extent the principals to be assigned to the PHA work were involved in the referenced experience. (Note: For proposal evaluation purposes, the experience of the principal(s) to be assigned to the PHA work will be given equal or greater weight that the experience of "the firm" as an entity). If the firm uses subcontractors, the PHA reserves the right to reject and request substitution without any cost change.

The PHA is only interested in qualifications, experience, track records (past performance) and technical competence which is DIRECTLY RELATED to the Scope of Services of

this commission.

Please feel free to include any other information about the firm which will assist the PHA in assessing the extent to which the firm has the professional experience, track record and technical competence to successfully perform the PHA commission.

2. ADDITIONAL ELEMENTS

If your firm has any questions about the general procurement process for this RFP, please direct them to

[PHA CONTACT INFORMATION]

B. DOCUMENT REQUIREMENTS

All proposals must include:

1. Incorporation certification, including the names and addresses of corporate ownership.

2. Evidence of valid license in the State, if applicable (i.e. architectural and engineering services).

3. If the firm intends to subcontract any portion of this job, a statement regarding to whom, with attendant corporate identification and certifications. Sub-contractors will be evaluated as part of the proposer's team. PHA reserves the right to accept or reject subcontractors with no change to price.

4. If not included in the PROFESSIONAL EXPERIENCE sections of the proposal, summary resumes of the firm's partners and principals to be assigned to prospective PHA work.

5. Certified statement that neither the firm nor members of the firm are debarred, suspended or otherwise prohibited from professional practice by any federal, State or local oversight, regulatory or law enforcement authority.

6. Statement that the firm is financially sound and has financial resources sufficient to successfully execute this prospective PHA agreement in the time frame outlined. Provide a financial statement of the firm upon request of the PHA.

7. Evidence of all appropriate and applicable insurance coverage carried by the firm, including policy coverage periods. Required insurance levels are as follows:

(PHA fills in required amount)

8. Statement that the firm operates in full compliance with all applicable civil rights and nondiscrimination statutes, executive orders, rules and regulations.

9. Statement evidencing firm's knowledge of Federal, State and Local codes, especially as they relate to this project.

10. Affidavit of Non-Collusion (attached).

11. Standard Form (SF) *255,* if applicable.

12. (Add any other specific documents/requirements that are unique to this RFP/Scope of Services).

VII. PROPOSAL EVALUATION CRITERIA

A. PROPOSAL EVALUATION CRITERIA

The PHA will evaluate all proposals received based upon two criteria with ranking points as follows:

1. FOR "PROFESSIONAL EXPERIENCE AND QUALIFICATIONS"

Maximum Score: 20 Points

Highest Rating: The professional experience described in the proposal is the same kind (or greater), in quality and scale, as is required to perform the Scope of Services described in this RFP. For example: the firm has had extensive experience with energy audits in public housing authorities or comparable experience in multifamily buildings or buildings with similar HVAC systems. If two or more firms meet this standard, the firm with the most relevant experience will receive the relatively higher score.

Medium Rating: The professional experience described in the proposal is quite similar, clearly approximates, is closely related to and/or otherwise quite comparable, in quality and scale, as is required to perform the Scope of Services described in this RFP. For example: same as for "highest rating", but not including specific, "experience with PHA proposals for appropriate services ". If two or more firms meet this standard, the firm with professional experience which is most similar to the scope of services will receive relatively higher scores.

Lowest Rating: The professional experience described in the proposal is somewhat similar, approximates, is somewhat related to and/or otherwise somewhat comparable, in quality and scale, as is required to perform the Scope of Services described in this RFP.

For example: the firm has extensive audit experience, but not with the specified programs or areas of emphasis for this commission.

2. FOR "COST"

Maximum Score: 10 Points

The Cost criteria will be scored in relative terms, i.e., lowest relative costs receiving the highest relative scores, with scoring differences proportional to cost differences.

If proposed cost is excessive, the PHA may, at its sole discretion remove the proposal from any further consideration.

3. FOR "INNOVATION"

Maximum Score: 10 Points
This score rewards thoughtful, creative, suggestions for conducting scope of work.

4. TOTAL MAXIMUM SCORE: 40 POINTS

APPENDIX A

ENGINEERING METHODOLOGY EXAMPLES

The following individual measure analysis protocols are intended to serve as illustrative examples of the analytical thoroughness expected of the Contractor in evaluating all appropriate measures. Please note that these examples do not include possible interactivity with other existing or recommended equipment or systems. It is not our intention to predict the many possible interactions, but the Contractor shall identify and analyze all possible interactive effects on a case-by-case basis.

Example #1 -- Lighting Fixture Replacement/Retrofit

Original Condition Parameters (Inputs):

For Energy Savings calculations:

- Location
- Fixture Type
- Number of Fixtures
- Number of Non-Operating Fixtures
- W per Fixture (including ballast, if present)
- Control device - wall switch, permanently on at breaker panel
- Annual Operating Hours

Retrofit Conditions:

Same parameters as above.

Testing Procedures:

If the Contractor and PHA cannot reach agreement regarding the estimated annual operating hours of fixture(s) (particularly in apartments), the Contractor may be required to install light-loggers. These are light-sensitive devices that accumulate hours of operation and can be adjusted to various light sensitivities. The loggers shall be installed on a statistically valid sample of the lighting fixtures in question for a period of time that includes all possible changes in schedule. The results of such testing will be the basis for the estimated annual operating hours. The parties shall negotiate the cost of such testing at the time of the request.

Energy Saving Calculation:

(Existing Annual Hours of Operation x W Per Fixture x Number of Fixtures) / 1,000

Minus

(Retrofit Annual Hours of Operation x W Per Fixture x Number of Fixtures) / 1,000

= Annual kWh Saved

Simple Payback Calculation:

Estimated Installation/Retrofit Cost / Annual kWh Saved x Marginal Cost / kWh

In most cases, Marginal Cost / kWh shall be based on the actual utility rate billed for the meter/account recording the lighting fixture use. If a rate change is necessitated by the energy and/or kW use reductions resulting from the implemented measures and/or if the PHA coincidentally purchases electricity on a commodity basis, an adjustment of the marginal kWh cost may be necessary to determine the actual simple payback. Additionally, the Contractor shall calculate the simple payback including the net effect on annual maintenance costs resulting from the lighting fixture retrofit. To calculate this payback, the Contractor shall take the following parameters into account:

- Average life of existing bulbs
- Cost of existing bulbs
- Average life of retrofit bulbs
- Cost of retrofit/new bulbs
- Staff time to replace each existing bulb
- Staff time to replace each retrofit/new bulb

The net increase/decrease in maintenance costs shall be added to the result of the denominator of the above simple payback equation to determine the combined simple payback. For purposes of an energy performance contract, based on HUD 24 CFR Part 965 and 990.109 as cited below, the effect of net maintenance cost shall not be included in the primary illustration of simple payback, but shall be stated separately in supporting documentation.

Under no conditions shall the Contractor analyze or propose the installation of a fixture or group of fixtures that individually or in combination do not adequately illuminate the space as defined by applicable electrical, health and safety codes. Where one code supercedes another regarding illumination levels, the more stringent code shall apply. In determining code compliance, the Contractor shall allow for degradation of illumination levels of bulbs and/or fixtures over time as published by the manufacturer(s).

The Contractor shall report any ballast(s) which may contain PCB's to the PHA. The Audit Contractor shall assume that the installation contract will include arrangements for the proper

disposal of all ballasts to be removed as part of the scope of work and include the cost of coordination and proper disposal in the installation cost estimate.

Example #2 -- Water Closet Replacement

Original Condition Parameters (Inputs):

For Water Saving Calculations:

- Average water pressure (per floor for high rise)
- Gallons per flush
- Estimate of number of flushes per day per water closet

Retrofit Conditions:

- New average or per floor water pressure
- Gallons per flush
- Flushes per day per water closet- same as original condition
- Apartment vacancy rate by apartment type (elderly, family, # of Bedrooms, etc.)

Testing Procedures:

If the Contractor and PHA cannot reach agreement regarding the estimated gallons per flush, the Contractor may be required to measure the gallons per flush of five (5) percent of existing water closets, taking into account variations in water pressure at various site locations. The devise used must be capable of measuring the water draw during the flush cycle, not just the volume of water contained in the bowl and tank (for gravity flush models). The average gallons per flush derived by such testing shall become the basis for determining water consumption savings. The parties shall negotiate the cost of such testing at the time of the request.
The Contractor may use manufacturer's gallons per flush ratings for the proposed water closet replacement, provided that the water pressure is within the limits under which the manufacturer(s) tested the product.

Water Saving Calculation:

Per water closet type:

Existing Gallons / Flush x # of Flushes / Day x 365 x # of water closets of type

Minus

New Gallons / Flush x # of Flushes / Day x 365 x # of water closets per type

= Annual water savings in gallons

Savings Sensitivity Analysis - The Contractor shall compare the total estimated water savings to the actual metered water use for the apartments receiving the water closets. Unless unusual conditions exist, the percent water savings should not be greater than 45% of the original total

use. If greater than this value, the Contractor shall document to the satisfaction of the PHA, the unusual conditions which led to the estimate.

Simple Payback Calculation:

Estimated Installation/Retrofit Cost / Annual Water Units Saved x Marginal Cost / Water Unit

The Contractor shall consider the following cost factors in calculating the Estimated Installation Cost:

- Number of water closets of each type
- Color
- Bowl Shape
- Handicap Model
- Floor/Wall Mount
- Floor/Wall Outlet
- Replace shut off valves (stops)
- Replace wax rings/flanges
- Flange type
- Footprint vs. Replacement model
- Finish floor type and condition
- Rough-in distance

In most cases, Marginal Cost / Water Unit shall be based on the actual utility rate billed for the meter/account recording the water closet use. If a rate change is necessitated by the water use reductions resulting from the implemented an adjustment of the marginal unit cost may be necessary to determine the actual simple payback. Marginal units should be expressed in the units shown on the utility company bill, generally either 1,000 gallons or hundreds of cubic feet (ccf's).

Example #3 -- Variable Frequency Drive Installation - Domestic Water Pressurization Pumps

Original Condition Parameters (Inputs):

For energy (kWh) and power (kW) Savings:

- Measured kW profile over 1 week (7 day) period
- Measured kWh profile over 1 week (7 day) period
- # of occupants served by pump station
- Manufacturer's rated horsepower (HP) at various flow rates
- Estimate of annual run time at various flow rates

Retrofit Conditions:

Same as above.

Testing Procedures:

The Contractor shall install a recording Watt-meter (Dranetz, or equal) and measure and record pump kW and kWh by time-of-use periods for one week. The Contractor will average the data to establish a pre-installation 24-hour load profile. Post-installation use will be established in the same manner, adjusted for any change in the number of residents.

Energy Saving Calculation:

The Contractor will estimate the annual kW and kWh savings by estimating the average annual run time under predicted variable load (HP) conditions. Actual energy and power savings shall be determined by the following formula, after post-installation testing is complete:

For kWh:

Pre kWh/day x 365 days/year

Minus

Post kWh/day x 365 days/year x (# of Pre Resident / # of Post Residents)

For kW:

Pre On-Peak kWh / Pre On-Peak Hours

Minus

Post On-Peak kWh / Post On-Peak Hours x (# of Pre Resident / # of Post Residents)

Simple Payback Calculation:

Estimated Installation/Retrofit Cost

Divided by

(Annual kWh Saved x Marginal Cost / kWh) + The Sum of (Monthly Peak kW Saved x Monthly Billed Cost /kW)

In most cases, Marginal Cost / kWh shall be based on the actual utility rate billed for the meter/account recording the pump electricity use. For time-of-use rates, the Contractor will calculate a weighted average marginal cost based on kWh savings per time period. If a rate change is necessitated by the energy and/or kW use reductions resulting from the implemented measures and/or if the PHA coincidentally purchases electricity on a commodity basis, an adjustment of the marginal kWh cost may be necessary to determine the actual simple payback.

Example #4 -- High Efficiency Natural Gas Domestic Hot Water Maker

Original Condition Parameters (Inputs):

- Entry Water Temperature (modeled monthly)
- Combustion Efficiency of Appliance
- Number of Residents served by system
- Storage Temperature
- Delivery Temperature
- Estimated Gallons per Resident per Day
- Estimated Stand-By Losses of System as a percent of Available Btu's

Retrofit Conditions:

Same as above.

Testing Procedures:

The Contractor shall use standard testing equipment to measure the combustion efficiency of the domestic hot water appliance.

Energy Saving Calculation:

For Therm savings:

When gas use for domestic hot water is metered with other uses:

The Annual Base Use shall be the Sum of Monthly:

(Average Outlet Temp. - Average Entry Temp.) x # of Residents x Gallons/Resident x Days/Month x 8.33 Pounds/Gallon

Divided by

100,000 Btu's/therm x Existing Appliance Efficiency x (1- % Standby Loss)

The Annual Therm Savings shall be calculated by substituting the new appliance efficiency and standby loss percentage in the above formula and subtracting the result from the Annual Base Use. If necessary, adjustments must be made for changes in the number of residents.

Simple Payback Calculation:

Estimated Installation/Retrofit Cost / Annual Therms x Marginal Cost / Therm

In most cases, Marginal Cost / Therm shall be based on the actual utility rate billed for the meter/account recording the appliance use. If a rate change is necessitated by the energy use reductions resulting from the implemented measures and/or if the PHA coincidentally purchases natural gas on a commodity basis, an adjustment of the marginal therm cost may be necessary to determine the actual simple payback.

Additionally, the Contractor shall calculate the simple payback including the net effect on annual maintenance costs resulting from the new equipment. To calculate this payback, the Contractor shall take the following parameters into account:

Change in Annual Cost of Service Contract, if any
Change in Annual Cost of Preventative Maintenance

The net increase/decrease in maintenance costs shall be added to the result of the denominator of the above simple payback equation to determine the combined simple payback. For purposes of an energy performance contract, based on HUD 24 CFR Part 965 and 990.109 as cited in Section III, B, the effect of net maintenance cost shall not be included in the primary illustration of simple payback, but shall be stated separately in supporting documentation.

Example #5 -- Refrigerator Replacement

Original Condition Parameters (Inputs):

- Watt rating
- Annual operating hours

Retrofit Conditions:

Same as above.

Testing Procedures:

If the Contractor and PHA cannot reach agreement regarding the estimated annual refrigerator operating hours, the Contractor may be required to install run-time meters on a statistically valid sample of the refrigerators in question for a period of time that includes all possible changes in schedule of use (door openings, etc.) but, in no case, fewer than two days. The statistical sample shall take into account variations is equipment age, condition, location and apartment occupancy type. The Contractor must make reasonable adjustments to the resulting data to account for any likely seasonal changes in ambient air temperature and humidity not present during the available test period. The results of such testing will be the basis for the estimated annual operating hours.

Energy Saving Calculation:

For kWh:

Existing Watts x Annual Operating Hours / 1,000

Minus

Replacement/New Watts x Annual Operating Hours / 1,000

= Annual kWh Saved

Simple Payback Calculation:

Estimated Installation Cost / Annual kWh Saved x Marginal Cost / kWh

The Contractor shall consider the following cost factors in calculating the Estimated Installation Cost:

- Quantity/Truckload Purchase Prices
- Residual Value of Existing Refrigerators

In most cases, Marginal Cost / kWh shall be based on the actual utility rate billed for the meter/account recording the appliance use. If a rate change is necessitated by the energy and/or kW use reductions resulting from the implemented measures and/or if the PHA coincidentally purchases electricity on a commodity basis, an adjustment of the marginal kWh cost may be necessary to determine the actual simple payback.

Example #6 -- Conversion of Clothes Dryers from Electric to Gas

Original Condition Parameters (Inputs):

- Number of Occupied Apartments Served by Dryers
- Estimate of loads per week per apartment
- kWh per dryer load

Retrofit Conditions:

- Number of Occupied Apartments Served by Dryers
- Estimate of loads per week per apartment
- Therms per dryer load

Testing Procedures:

If the Contractor and PHA cannot reach agreement regarding the estimated annual dryer loads, the Contractor may be required to install run-time meters on a statistically valid sample of the dryers in question for a period of time that includes all possible changes in schedule of use (weekends, etc.) The results of such testing will be the basis for the estimated annual dryer loads. The parties shall negotiate the cost of such testing at the time of the request. Alternatively, if the drying equipment is rented a review of the vendor's annual cash receipts should yield the number of annual loads. If the resulting new gas use is combined with a meter serving other uses, the post retrofit gas use may either be calculated based on the manufacturer's gas input rating and the estimated or tested annual dryer loads. If agreement cannot be reached, the Contractor may be required to test and record gas burner "on-time."

Energy Saving Calculation: Not Applicable. This is a Cost Reduction Opportunity.

Simple Payback Calculation:

Estimated Installation Cost

Divided by

Pre Annual kWh x Marginal Cost / kWh - Post Annual Therms x Marginal Cost /Therm

The Contractor shall consider the following cost factors in calculating the Estimated Installation Cost:

- Dryer venting requirements necessary to meet local codes
- Size and length of gas piping necessary from meter location to dryer location
- Gas utility charges to set meter, if any
- Necessary rewiring of laundry to accommodate new dryers and/or venting equipment
- Changes in lease costs (if equipment leased from vendor)

In most cases, Marginal Costs shall be based on the actual utility rate billed for the meter/account recording the dryer use. If a rate change is necessitated by the energy use reductions or increases resulting from the implemented measures and/or if the PHA coincidentally purchases electricity and/or gas on a commodity basis, an adjustment of the marginal cost may be necessary to determine the actual simple payback.

APPENDIX B

SIMULATION SOFTWARE MANUFACTURER'S CONTACT INFORMATION
12/99

BLAST (Building Loads Analysis and System Thermodynamics)

Building Systems Laboratory
University of Illinois
1206 West Green Street
Urbana, Illinois 61801
(217) 333-3977
fax (217) 244-6534

DOE-2

Fred Winkelmann
Lawrence Berkeley National Laboratory
Mail Stop 90-3147
1 Cyclotron Road
Berkeley, California 94720
(510) 486-5711
fax (510) 486-4089

EZDOE

Elite Software
P.O. Drawer 1194
Bryan, Texas 77806
(409) 846-2340
fax (409) 846-4367

HAP v.4.0 (Hourly Analysis Program)

Carrier Corporation
Software Systems
TR-1, Room 250
P.O. Box 4808
Syracuse, New York 13221
(315) 432-6838
fax (315) 432-6844

TRACE 600 (Trane Air Conditioning Economics)

Trane C.D.S. Support Center
Trane Company
3600 Pammel Creek Road
Building 17-1
La Crosse, Wisconsin 54601-7599
(608) 787-3926
fax (608) 787-3005

VisualDOE

Eley Associates
142 Minna Street
San Francisco, California 94105
(415) 957-1977
fax (415) 957-1381

APPENDIX C

MEASURE TABLE

1. HIGH RISE BUILDINGS

Building Envelope (measures reducing conduction, infiltration losses)

Windows - replacement, storm, weatherstripping, permanent window-mount A/C sleeves
Roof – replacement w/ new flat roof and insulation system, additional insulation in attic areas
Exterior walls – exterior or interior insulation, weatherproofing, A/C sleeves
Entrance Doors – entrance door upgrades to air locks, replace curtain window walls around building entrances
Apartment doors – replace patio/balcony doors, weatherstripping of patio/balcony doors

Mechanical Systems

Space heating system component replacement – boiler, heat pump

Steam:
New modular boilers
Burner replacement

Hot Water:
New condensing boilers
Modular boilers/burners

Space heating system controls upgrade – boiler control, apartment controls

Steam:
Time cycle controller such as Heat-Timer EPU
Averaging thermostatic control
Sequencer/stager for modular system
Outdoor high temperature limit
Radiator zone valves – non-electric
Temperature limited thermostat
Programmable thermostat
Condensate leaks
Steam traps

Hot Water:
Reset ratio control

Sequencer/stager for modular system
Outdoor high temperature limit
Radiator zone valves – electric, non-electric
Temperature limited thermostat
Programmable thermostat
EMS systems

Fuel conversion of space heating appliances – electric to gas-fired (usually requires entire distribution changeout), oil to gas (may be isolated to boiler room), district steam to building-based gas- or oil-fired boilers (consider construction type and boiler room location in estimating cost-effectiveness).

Distributed Generation

Cogeneration/Combined Cycle Gas

Insulation

Heating
Domestic hot water
A/C chiller
Pipe

Electrical Motors

Replace heating system circulating pump(s) with smaller capacity pump(s), replace water pressure booster station pump and/or staging/sequencing controls

Air Conditioning

Wall mount
Window mount
Chiller
Cooling tower

Domestic Hot Water System

Controls upgrade
Demand-based temperature setback
Condensing gas-fired heater
Modular boilers or modulating burner
Sequencing/staging control
Insulation – piping, storage tank
Replace storage tank (calculate payback if existing storage tank is in poor condition and requires replacement)

Ventilation

Replace major components - convert make-up air systems to gas or oil
Replace supply fans with more appropriate sized-fans
Convert belt-driven fans to direct drive fans
Replace fan-motors with high efficiency motors
Replace fan-motors with variable speed
Replace/repair of duct dampers, timers or duty cycling on fan-motors
Retrofit make-up air/exhaust fans with air-to-air heat exchangers

Lighting

Replace incandescent light fixtures with fluorescent fixtures that employ T8 or compact fluorescent lamps and electronic ballasts
Replace halogen torchieres with fluorescent torchieres in apartments
Retrofit existing fluorescent fixtures with T8 or compact fluorescent lamps and electronic ballasts
Replace mercury vapor or incandescent exterior lighting with metal halide or high pressure sodium fixtures
Install photocontrols on light fixtures, exterior mainly but also on fixtures found in interior spaces with an abundance of natural daylight
Install occupancy sensors on light fixtures

Waste Disposal

Renegotiate/rebid private waste disposal contracts
Renegotiate private waste disposal costs if recycling program is initiated
Recycle aluminum, paper, glass and/or plastics
Build new or rebuild existing incinerator and/or trash compactors

Household Appliances

Replace owner-furnished Refrigerator
Replace owner-furnished clothes washers with horizontal-axis washers
Convert electric clothes dryers to gas dryers

Water

Low-flow showerheads
Low-flow aerators
Low-volume water closets
Water Closet retrofit kits
Leak repair/faucet replacement
Water pressure reduction
Horizontal axis clothes washers

2. TOWNHOUSE AND GARDEN STYLE BUILDINGS

Building Envelope (measures reducing conduction, infiltration losses)

Windows - replacement, storm, weatherstripping
Roof – additional insulation in attic areas
Exterior walls – exterior or interior insulation, weatherproofing, A/C sleeves
Entrance Doors – weatherstrip
Apartment doors – replace patio/balcony doors, weatherstripping of patio/balcony doors

Mechanical Systems

Space heating system component replacement – boiler, heat pump

Warm Air:
Replace with high efficiency gas furnaces
Convert individual electric heat and DHW to individual or central high e gas
Convert master meter to individual utility or owner meters

Hot Water:
Replace with high efficiency boilers
Convert central electric to central high e gas or individual high e gas
Convert individual electric heat and DHW to individual or central high e gas
Convert master meter to individual utility or owner meters

Space heating system controls upgrade – boiler control, apartment controls

Warm Air:
Install boiler reset controls
Thermostats (limiting and setback)

Hot Water:
Install boiler reset controls
Zone valves (electric and non-electric)
Thermostats (limiting and setback)

Insulation

Wall
Attic

Floor
Perimeter
Pipe
Duct

Air Conditioning

Wall
Window
Coil and condenser for each apartment with warm air furnace

Domestic Hot Water System

Condensing gas-fired heater
Modular boilers or modulating burner
Sequencing/staging control
Insulation – piping, storage tank
Replace storage tank (calculate payback if existing storage tank is in poor condition and requires replacement)

Ventilation

Rooftop exhaust timers

Lighting

Replace incandescent light fixtures with fluorescent fixtures that employ T8 or compact fluorescent lamps and electronic ballasts
Replace halogen torchieres with fluorescent torchieres in apartments
Replace mercury vapor or incandescent exterior lighting with metal halide or high pressure sodium fixtures
Install photocontrols on light fixtures, exterior mainly but also on fixtures found in interior spaces with an abundance of natural daylight

Waste Disposal

Renegotiate/rebid private waste disposal contracts
Renegotiate private waste disposal costs if recycling program is initiated
Recycle aluminum, paper, glass and/or plastics
Build new or rebuild existing incinerator and/or trash compactors

Household Appliances

Replace owner-furnished Refrigerator
Replace owner-furnished clothes washers with horizontal-axis washers
Convert electric clothes dryers to gas dryers

Water

Low-flow showerheads
Low-flow aerators
Low-volume water closets
Water closet retrofit kits
Leak repair/faucet replacement

APPENDIX D

EXISTING CONDITONS AND AVAILABLE DATA

A. EXISTING CONDITIONS

The Contractor shall, at a minimum, document the following existing conditions listed in Appendix D at each site listed in this RFP. The Contractor shall determine the existing conditions by a combination of site inspection, review of as-built drawings and specifications (if available), and any written statements as to existing site conditions that may be provided by the PHA to the Contractor. Existing conditions, which are based solely on the verbal statements of management or maintenance personnel, shall be so noted by the Contractor in the Study text. If requested by the PHA in Section III. B., the Contractor shall provide a full equipment inventory as described in Appendix F.

Documents available to the Contractor to complete the following tasks shall include as built drawings, utility use histories in summary form and/or copies of original bills, proposed and previously implemented energy related modernization plans and previously completed energy audits and surveys.

B. AVAILABLE DATA (provided by the PHA)

Drawings of existing facilities (if available).
Reasonable escorted access to facilities and apartments.
Utility use histories and account numbers

C. GENERAL INFORMATION

Site Name:

Street Address:

Total Number of Buildings:

Total # of units:

Building Type(s) - Low-/high-rise, garden, walk-up, townhouse, flats:

At the time of the Study and (if different) during energy and water use base period analyzed:

Number of occupied units
Average number of occupants per unit
% of elderly-occupied units
% of family-occupied units
% other-occupied units (student, working couple, etc.)

Meter Information:

Electricity centrally/individually metered/paid:

Number of master meters
Meter serial numbers
Approximate Locations

Gas centrally/individually metered/paid:
Number of master meters
Meter serial numbers
Approximate Locations

Water centrally/individually metered/paid:
Number of master meters
Meter serial numbers
Approximate Locations

The Building Envelope

1. Structure

of floors:

Typical ceiling heights: apartments, hallways, utility rooms

Roof composition, pitched/flat, venting:

Floors: Composition (Poured concrete, precast, flexicore [hollow], etc.)

Exterior walls composition (structural and insulation):

Basements or crawl spaces:

2. Windows and Doors

Draft complaints:

Windows:

Configuration(s):
Frame type (material composition):
Single/double glazed:
Spacing:
Thermal Break:
Coating/fill:
W-strip condition:
Operating force:
Approx. size of most common openings (living room, kitchen, master bed, bed)

Interior storms:

Doors:

Front:

Solid/hollow/insulated, glazing:
W-strip type, condition:
Threshold type, condition:

Rear:

Solid/hollow/insulated, glazing:
W-strip type, condition:
Threshold type, condition:

Sliders:
- Size (approx.)
- W-strip type, condition
- Threshold type, condition
- Available space underneath threshold if any (photo)

Heating and Domestic Hot Water

Existing equipment:

Make and model
Input/output
How controlled ?
Motor horsepower (1 HP or greater circulators or blowers)

Average air temperature in common areas and apartments:
How common area and apartment air temperatures are controlled
Heating system distribution type and condition (air and/or water leaks, fin, filter, damper condition)

Appliance/boiler Venting configuration and condition:

Domestic hot water recirculation system present? Condition? How controlled?

Pipe Insulation

Age, Type, Condition,
Lineal feet of uninsulated pipe by type (hydronic heating, steam heating, cooling, domestic hot water), size and ambient air location.

Ductwork

Age, Type, Condition,
Lineal feet of uninsulated duct by type (heating, cooling) , size, and ambient air location.

Ventilation

Make-up air?
- Heat source:
- In service?
- On Timer/Schedule?
- Motor horsepower

Bathroom vents forced/induced/none:

On Timer/Schedule?
Motor horsepower
Damper type and condition

Range hoods forced/induced/recirculating/none:

Air Conditioning

Central/Window/Wall Sleeve
Electric, Gas , Heat Pump, Ground Source, etc.
Efficiency rating
Who owns?
Who pays? (add to rent?)
110V or 220V?
If window or wall sleeve, how many installed and in use last summer?
If central, age, condition and description of system components.

Lighting and Appliance Electrical Loads

Are apartment uses on master or individual electric meters?

Lighting

Interior:
Common Areas:
Fixture and Bulb Type:
By Location, Approx. quantity per area, building, or floor
Ballast Type
Approx. operating schedule
Number of Non-Operating Fixtures
Every other off/disconnected/on emergency generator?
Control Device - wall switch, permanently on
Apartment:
Fixture and Bulb Type:
By Location
Ballast Type
Approx. on time per day
Who purchases replacement bulbs?
Who installs replacement bulbs?
Exterior:
Pole Type/Height
Bulb Type
Quantities
Photo/Sensor
Appliances:

Range - electric or gas
Refrigerator
- Make and Model of most common types
- Approx. quantity of each type
- Age of most common types
- Quantities
- Frost Free/Manual

Elevators
- Horsepower of motors
- Condition of motors and controllers

Laundry and Cooking Facilities

Gas/electric ranges: quantity, age and condition. Who owns?

Laundry Location(s)
- Electric or Gas Dryers and Washers
- Front or Top Load Washers
- Quantities
- Who owns? / Leased from who?

Plumbing Fixtures

Street water pressure as read from meter location
- Is water pumped to upper floors or to holding tank at or near top of building?
- Incoming street pressure
- Pressure downstream from pumping station?
- Is pressure dependent pump controller installed and operational?
- Pump horsepower and operating schedule.

Water Closet Model:
Gravity flush or Flushometer type:
Approx. gallons per flush
Are water-conserving flush devices installed? If yes, what type. When installed. Condition.
Rough-in:
Rim height:
Floor/wall mount:
Floor/wall outlet:
Round or Elongated Bowl
Color of bowl/tank
Shut-off valves present at each toiler? Condition?
Floor composition/condition at water closet location

Total number of water closets at site. Number per apartment per number of bedrooms.

Showerhead capacity label, if any (info may be in site maintenance shop):
Bath aerator capacity label, if any:
Kitchen aerator capacity label, if any:

APPENDIX E

AUDIT OUTLINE

ENERGY PERFORMANCE CONTRACT ENERGY AUDIT

for the

[PHA]

by

[CONTRACTOR]

[DATE]

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PREFACE

PART I - OVERVIEW OF ACTIVITIES AND FINDINGS

I. OVERVIEW OF ACTIVITIES AND FINDINGS

A. GOALS AND OBJECTIVES

The goals of the Energy Audit for this Performance Contract are:

B. AUDIT ACTIVITIES

1. Base Line Development

2. Base Rate Analyses & Related Recommendations

Natural Gas

Electricity

Water

3. Measure Analyses and Recommendations

4. Term of the Project and Financing Strategy

TABLE 1: Gas Base Summary
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1. Recommended Measures

PART II - DEVELOPMENT REPORT

A. DESCRIPTION OF EXISTING CONDITIONS

1. General Information

2. Metering Information

3. Building Envelope

4. Building Systems

Space Heating

Domestic Water Service & Systems

Ventilation

Air Conditioning

Lighting and Appliances

Laundry and Cooking

Plumbing Fixtures

B. HISTORY OF ENERGY USAGE

1. Description of Base Usage

Natural Gas Use

Gas End Uses:

Gas Base Line:

Electricity Use

Electric End Uses:

Electricity Base Line:

Water Use

Water End Uses:

Water Base Line:

GAS BASE LINE
GAS BASE DATA AND BASE YEAR GRAPHS
ELECTRICITY BASE LINE
ELECTRICITY BASE DATA AND BASE YEAR GRAPHS
WATER BASE LINE
WATER BASE DATA AND BASE YEAR GRAPHS

C. MEASURE RECOMMENDATIONS

1. Description of Measures/Calculation Methodology

The table included at the last page of this Individual Development Report entitled **"Summary of Recommendations"** illustrates the simple paybacks calculated for various recommended measures.

SUMMARY OF RECOMMENDATIONS

PART III: ENERGY EFFICIENCY FINANCING (Energy Performance Contracting)

A. FINANCING OPTIONS

1. Sources of Financing

2. Utility Rates -Floor and/or Ceiling

3. Savings Guarantee Provisions

4. Owner Cost Share

5. Direct Procurement of Utilities/Utility Incentives

6. Preliminary Cash Flow Projections (Table)

B. TENTATIVE SCHEDULE OF TASKS FOR FINANCING AND IMPLEMENTATION

Month

Week 1:	× _____
Weeks 2-3	× _____ × _____ × _____
Week 4	× _____

Month

Weeks 1-2:	× _____ × _____

APPENDIX F

OPTIONAL EQUIPMENT INVENTORY

Scope of Work

While conducting the Energy Audit the Contractor shall gather the following information about the equipment and systems inspected (e.g., any equipment present at the site(s) which is listed on the attached Measure Table), whether or not the equipment and/or system is recommended for replacement:

- Location, serial number, and quantity of each by manufacturer, model number, capacity, date of installation and physical condition.

- Metering equipment meter number, manufacturer, model number, building, location, type, multipliers, and area(s) served.

The above data shall be presented by the Contractor to the PHA both in written and electronic form, using software compatible with the PHA's computer database/spreadsheet software. This data can then be used by the PHA to develop a standardized building equipment database that functions as the foundation for a comprehensive development management (CDM) program that will be useful for a PHA's internal equipment inventories and for reporting to HUD.

APPENDIX G

TERMS AND CONDITIONS

[Note: The PHA should insert any PHA-specific terms and conditions here.]